**INDUSTRIAL TECHNOLOGY CENTRE/MANITOBA RESEARCH COUNCIL**

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# MANITOBA RESEARCH COUNCIL

# INDUSTRIAL TECHNOLOGY CENTRE

# SERVICES AND CAPABILITIES

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# INDUSTRIAL TECHNOLOGY CENTRE

## 1.0 INTRODUCTION

The Industrial Technology Centre (ITC) was established by the Manitoba Research Council as a non-profit R & D facility to serve Manitoba industry. To this end, the Centre has become involved in a wide range of projects and is accredited by the Standards Council of Canada for specific tests registered with the Council.

The objectives of the ITC are to: provide scientific and technical services to industrial and government clients, stimulate the application of new technology in Manitoba industry, aid in translating technology into local manufacturing opportunities, and enhance the appeal of Manitoba as an industrial/technology location. Two types of services are provided to industrial clients, namely; consulting and product/prototype development services on a contractual basis, and a wide range of technical information and advisory services.

Areas of Centre expertise are in biotechnology, chemical technology. computer aided engineering, electrical and electronics engineering mechanical and manufacturing engineering, and materials engineering. The present capabilities and services provided by ITC are outlined in the following sections of this document.

ITC has offices in Winnipeg and Brandon. Further information on the capabilities and services available to clients may be obtained by contacting either office.

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## 2.0 TECHNICAL INFORMATION AND ADVISORY SERVICE

### 2.1 Introduction

ITC provides a comprehensive technical information and advisory service to assist clients in their technical and related business decision making processes.

### 2.2 Information Service

A variety of information services-ranging from literature searches to patent reviews-are provided by ITC. This client service is funded by the Manitoba government. The only charges which clients will incur when accessing this information service-are those computer data search and other information retrieval costs incurred in undertaking work for a client.

#### 2.2.1 Literature Searches

Literature searches are conducted to produce bibliographies listing articles, reports, books or other publications. While the majority of searches are for bibliographic information, other searches are carried out for data which range from information on company sales to the identification of a substance according to an analysis of its atomic absorption spectrum.

#### 2.2.2 Library Loans

Most material, except reference documents in the library. is available for loan to staff and clients.

#### 2.2.3 Interlibrary Loans

The library cooperates with most other local and major Canadian libraries in an interlibrary loan system. These libraries also communicate through electronic messaging systems which enable ITC to obtain nearly all published material within a short period of time.

#### 2.2.4 Fact Finding

Specific facts and figures may be obtained, such as addresses, telephone numbers, names of agencies and suppliers. ITC has access to a number of computer databases which also are used to obtain information required by clients.

2.2.5 Consulting Services

Assistance is provided in areas related to management or retrieval of information, such as reports, vendor literature, books, standards, or other documents.

2.2.6 Patent Information

Assistance is provided to clients in locating information in worldwide patent literature. This information is provided either as a source of technical information or as an indication of activity in a particular area. Searches are carried out to locate patents on a particular subject and may include English language equivalents of a foreign patent, additional information about and claims of particular patents, and information about the patent system. Through an Agreement with the Department of Consumer and Corporate Affairs, ITC can obtain a cross section of patents on a particular topic, and provide other intellectual property information.

2.3 Advisory Service

ITC recognizes that many clients require assistance in: evaluating manufacturing production and processes; assessing the viability of current and leading edge technologies; assessing computer options; defining the requirements of research and development projects. In order to address this need, ITC provides a no-cost advisory to Manitoba industry. This service is funded by the provincial government and by NRC through a contribution agreement with the Manitoba Research Council.

This service includes the following elements:

2.3.1 Industrial, electronic and manufacturing engineering services including: plant layout, equipment selection, review of manufacturing methods, value analysis/cost reduction, cost estimating, evaluation of new technologies, identifying source of components and services, assistance in product development and engineering documentation and control.

2.3.2 Provision of information on Provincial and Federal government programs which may assist a client in undertaking a required R & D project.

2.3.3 Delivery of the National Research Council-Industrial Research Assistance Program in Manitoba. The Industrial Research

Assistance Program (IRAP) - Field Network is directed towards medium to small firms. The program provides technical and financial assistance to foster the use of available technology, and to increase the calibre and range of research and development in industry.

2.3.4 ITC provides hands-on introductory demonstrations of VAX and PC based application systems to enable clients to develop staff expertise and evaluate software options. These options include Computer Aided Design Drafting (CAD), Computer Aided Manufacturing (CAM), and Computer Aided Engineering (CAE). Computer terminals also are available to clients for remote access to ITC's facilities.

## 2.4 Facilities

### 2.4.1 Technical Library

ITC has an extensive collection of material on industrial technologies. It also has immediate access to the collections of many other resource centres, locally and throughout the country. Our collection includes over 3,000 books, 20,000 technical reports, 400 periodical titles, standards from over 300 organizations, many specialized product directories, a small collection of video tapes, and a microfilm service containing over two million pages of vendor catalogues. Contracts have been established with seven computer database services. These give immediate access to over three hundred databases covering a wide variety of topics. Examples of these include: general engineering articles, company information, electronics, welding, business news, suppliers, patents, plastics, safety, standards and market research.

### 2.4.2 Computer Facilities

ITC has a VAX 11/780 mini computer, and IBM, Sperry and MacIntosh personal computers. The software packages available for client demonstration include SDRC, Calma, Versacad, Prodesign II, Learn, Payback, Plant Layout, Lotus, Multiplan, MacProject, Redlogg and Redboard.

## 3.0 ELECTRICAL/ELECTRONICS ENGINEERING

### 3.1 Introduction

Electrical and electronics engineering services are offered by ITC which include design, product development assistance and general consulting.

### 3.2 Services

#### 3.2.1 Design

The design services of ITC-in most cases-lead to the development of new products. These services centre around the following activities:

a) Electronic Circuit Design: This includes the design of wide variety of devices ranging from simple to complex circuitry. The Centre is capable of turning a concept into a fully tested prototype.

b) Computer Based System Design: Systems range from microprocessor to minicomputer based products. Activities can include both hardware and software development.

c) Communications System Design. Services include design and implementation of protocols and design or selection of network hardware.

d) Industrial Applications: This includes plant modernization and automation, and process measurement and control.

#### 3.2.2 Product Development Assistance

The following services are offered to clients engaged in product development:

a) Product Selection Assistance: Assistance is offered to clients in identifying and selecting products for use in prototype and product development.

b) Product Testing and Evaluation: This includes environmental and stress testing as well as premarket evaluation and consulting.

## 3.3 Past Projects

The following project list is a representative sample of past projects which illustrate the breadth of ITC's activities.

### 3.3.1 Micro to Mainframe Communications Controller

The client required a device which would allow multiple personal computers from a variety of vendors to exchange files with a mainframe computer. The Centre provided a solution consisting of an off-the-shelf microprocessor board and a custom designed communications controller. Extensive services were offered including system design, packaging design, hardware design and software design.

### 3.3.2 Automation of a Concrete Plant

The client required computer control of his batching operation. The Centre supplied a turn-key computer based solution. This involved subcontractor and trades management, hardware design and software design.

### 3.3.3 Transformer Design

The client presently supplies high intensity lighting kits to a variety of customers. The Technology Centre was contracted for the design of ballast transformers. ignitor circuits and manufacturing test equipment.

### 3.3.4 Feasibility Studies

A variety of feasibility studies have been undertaken including:

- Computer Based Truck Driving Simulator
- Air Seeder Instrumentation
- Plastics Production Line Instrumentation
- Remote control of underground mining equipment

## 3.4 Facilities

Our electrical/electronic laboratory is capable of supporting a variety of development and prototyping activities. Major equipment includes:

- Microprocessor development and debugging aids
- Computer aided engineering tools for printed circuit board development

- Oscilloscopes
- Logic analyzer
- Spectrum analyzer
- Protocol analyzer
- High frequency counters
- Radio frequency signal source
- Power supplies
- Digital volt meters
- Dielectric tester
- Power meter

## 4.0 MATERIALS ENGINEERING

### 4.1 Introduction

Materials Engineering services are provided by ITC to assist its clients to resolve problems involving materials testing and analysis, process development, and product testing and development.

### 4.2 Services Offered

The following services are offered by ITC.

#### 4.2.1 Material Testing and Product Evaluation

Testing is performed to CSA, CGSB, ASTM and other industry standards. In many cases, field service conditions are simulated to evaluate the performance of a new product. Through these services, design verification can be performed for new products/materials which can be made from plastics, metals or wood.

#### 4.2.2 Metallurgical Analysis

Assistance is provided to clients in metallurgical evaluation of components in terms of hardness, tensile, compression and fatigue testing, metallography for microstructure examination and heat treatment. Analysis of failed components and weldments is routinely performed. Chemical analysis of materials and non-destructive testing of components are also available. These services are often employed by clients to evaluate product quality control. Larger projects can also be undertaken where a product is being developed using new metallurgical processes including heat treatment, electroplating, and powder metallurgy.

#### 4.2.3 Advanced Industrial Materials

ITC offers technical information and advice for applications of new materials including fine ceramics, amorphous metals and composites.

### 4.3 Past Projects

The following project list is a representative sample of past projects undertaken by ITC:

- mechanical strength evaluation of polyethylene pipes
- dynamic testing of bus step-well
- compression testing of aluminum ladders

- failure analysis of copper/nickel tubes
- fatigue cracking of high strength steel studs
- hardness testing of aircraft components
- feasibility of using metallic glasses in force transducers

## 4.4 Facilities

The following equipment is used to support material engineering services provided by ITC:

- Universal Testing Machines up to 55000 lbf capacity (tension and compression), servohydraulic system permits fatigue testing.
- Impacter tester with low and high energy and temperature capabilities.
- Hardness testers - Brinell, Vickers, Rockwell, Barcol and Durmeter.
- Metallography - optical microscopes along with complete line of metal cutting, polishing and etching equipment.
- Environmental chamber - 40 to +60°C, programmable for temperature cycling.

## 4.5 Accredited Tests

ITC is accredited by the Standards Council of Canada as a testing Organization for specific tests registered with the Council. These tests are:

### 4.5.1 Building Materials:

Flammability of Insulated Panels (ITC Method)
Flexure, Modulus of Rupture of Glass and Windows (ASTM C158)
Performance of Safety Glass, Tempered or Laminated (CAN2-12.1M)
Structural Properties of Building Panels (ASTM E72)

### 4.5.2 Adhesives and Sealants:

Strength -
    Peel, of Adhesive Bonds (ASTM D903)
    Shear, Flat, of Sandwich Constructions (ASTM C273)
    Shear, Lap, in Tension, of Rigid Plastic Joints (ASTM D3164)

### 4.5.3 Plastics:

Density of Rigid Cellular Plastics (ASTM D1622)
Strength -
    Bursting, of Plastic Tubing (ASTM D1180)
    Compressive, of Rigid Cellular Plastics (ASTM D1621)

Flexural (ASTM D790)
Tensile, of Rigid Cellular Plastics (ASTM D1623)
Strength of Plastic Pipe -
Constant Internal Pressure (ASTM D1598)
Hydraulic Pressure (ASTM D1599)
Tensile Properties. General (ASTM D368)

4.5.4 Rubber and Resins:

Compression Set (ASTM D395)
Hardness -
Durometer (ASTM D2240)
Durometer, of Elastomeric Sealants (ASTM C661)
Strength -
Tearing (ASTM D624)
Tensile (ASTM D412)

4.5.5 Metals:

Fatigue -
Constant Amplitude Axial (ASTM E466)
Hardness -
Brinell (ASTM E10)
Rockwell and Rockwell Superficial (ASTM E18)

Mechanical Properties. General -
Fasteners and Rivets (ASTM F606)
Steel, Structural Quality, Rolled or Welded (CAN3-G40.20-M)Truss
Plates in Lumber Joints (CSA S347)
Wrought and Cast Aluminum Products (ASTM B557)
Wrought and Cast Steel Products (ASTM A370)
Welds (ASME Boiler and Pressure Vessel Code, s. IX Welding and Braizing. Ar I and IV)
Strength -
Impact, Notched Bar (ASTM E23)
Tensile (ASTM E8)

4.5.6 Packaging:

Shipping Container Vibration (ASTM (D999)

4.5.7 Electrical Power Insulators:

Mechanical Tests (ANSICZ9.1 Section 5.1)

# 5.0 MECHANICAL ENGINEERING

## 5.1 Introduction

ITC has experienced mechanical engineering staff and tools to support industrial clients in all phases of the product development cycle. This includes initial conceptualization, detail design, design refinement, preproduction engineering and product testing services. With ITC's support, client concepts are turned into manufacturing realities in a timely and cost effective manner.

## 5.2 Services

The mechanical engineering services assist clients by:

- providing improved product design to reduce production costs;
- reducing development times and costs; and
- improving product quality, reliability, performance and versatility.

These mechanical engineering services may be categorized as follows:

- Mechanical Design and Analysis
- Prototype/Product Fabrication
- Product Testing

### 5.2.1 Mechanical Design and Analysis

The mechanical engineering staff provide product design and analysis assistance to industrial and government clients. Technical problems related to product form or packaging, function, structural integrity, system dynamics, safety and cost effectiveness are dealt with.

Most of the above work is done using advanced design tools such as the Integrated Design Engineering Analysis Software package of SDRC. This software, run on a VAX 11/780 computer, is a family of powerful programs that share a common database for the following:

- Solid modelling
- Finite element analysis
- Modal analysis
- Fatigue analysis
- System dynamic analysis

Product performance, reliability and cost may be thoroughly evaluated and understood before any commitment to manufacturing tooling is made. Costly prototype construction and development time is minimized when these techniques are utilized.

Detailed design drawings are produced using either a G.E. CALMA 3D drawing system (also run on the VAX 11/780) or a 2D VERSACAD drawing system available on a number of personal computers.

5.2.2 Prototype/Product Fabrication

Fabrication of prototypes and products are possible through the use of ITC's machine shop. This facility offers custom machining and fabrication services to produce and test prototypes to customer specifications. These include:

- general machine work using conventional equipment
- sheet metal fabrication
- general welding and steel fabrication
- heat treating (limited)
- tool and die
- plastic extrusion dies
- injection mold cavities
- precision tool fixtures, gauges, templates, aircraft and aerospace components

5.2.3 Product Testing

Client products are tested by the Centre to national standards and regulations. ITC is accredited by the Standards Council of Canada for the following tests:

- Solid fuel fired appliance safety testing in accordance with (CSA B366.2/ULC S627)
- Retention and Release of Bus Windows (CMVSS No. 217. Para 217)

In addition, the Centre has facilities and personnel to perform many additional tests, including the following:

- CSA B415, ASTM, Oregon DEQ and Colorado Air Pollution Control Divisions Standards for woodstove emissions and efficiency
- Factory built chimney testing in accordance with ULC-S629-M1981
- Engine dynamometer testing to SAE J1312.

5.2.4 Vibration/Modal Analysis

Modern equipment is employed for field measurement and analysis of noise and vibrations in plant machinery. Structural failures related to excessive vibrations can be evaluated through modern computer aided modal analysis techniques.

## 5.3 Past Projects

The following list is representative typical mechanical engineering projects undertaken for ITC clients:

- solid finite element modelling and analysis of a high pressure pipe cleanout
- design, draft and prototype of a rotating advertising display unit
- CNC manufacture of a prototype electronic equipment mounting panel
- finite element analysis of a car shredder hammer
- vibration monitoring of calender stacks in a paper mill
- measuring dynamic strains in a prototype machine
- experimental development and dynamometer testing of an ammonia fueled engine for the National Research Council
- design review of a crop divider
- wood stove testing

## 5.4 Facilities

The following software and equipment is used by mechanical engineering staff:

- SDRC's IDEAS software which includes a finite element stress analysis package for beam structures (FRAME), an interactive finite element stress analysis package for solids and shells (SUPERTAB/SUPERB) and an interactive solids modeller (GEOMOD) and component assembler (SYSTEM DESIGN).
- GE's interactive three dimensional wire frame modeller and design drafting system (CALMA DDM).
- 4-Channel FFT analyzer for vibration and sound analysis.

  4-Channel FM tape recorder, and vibration table (shaker).
- Wood stove test cell.
- Engine dynamometer test cell with computerized data acquisition system.

- Exhaust emission analysis equipment.
- Hot gas generator for testing factory built chimneys.
- EDM cutting on an Andrews 2-axis travelling wire electric discharge machine.
- A Toyoda true 5-axis machining centre and a Hamai 3-axis vertical machining centre.

## 6.0 CHEMICAL TECHNOLOGY

### 6.1 Introduction

A wide range of chemical and biotechnology services are provided to clients which include analysis and testing, and product development.

### 6.2 Services

#### 6.2.1 Chemical Analysis

Capabilities in this area include environmental contaminants, waste analysis, air quality monitoring, fuels and lubricants analysis, contaminant identification, and verification of specification parameters.

#### 6.2.2 Product Development Assistance

Clients are provided with assistance in the development of their product by:

- Material Evaluation and Sourcing: There are over four million chemical compounds available today, some made by several manufacturers. ITC has access to computer databases, microfiche and hard copy information to aid clients in material sourcing.

- Micro-organism Identification: Various materials and manufactured products are analyzed to determine their microbiological characteristics and suitability for intended purposes. Identification of micro-organisms and related monitoring programs are provided as an integral component of this service.

- Formula Review: Though proprietary products are protected by copyright, there are many non-proprietary formulae available which can be prepared and retailed. Assistance is provided to clients in the selection and improvement of product formulae.

- Quality Control Testing: ITC assists clients in the identification of product quality problems and advises on the selection of tests and procedures to improve quality control.

- Process Evaluation: Assistance is provided to clients through the evaluation of chemical processes to determine their viability and applicability to client requirements and conformity to environmental regulations.

### 6.3 Past Projects

The following list is illustrative of the range of chemical technology projects undertaken for ITC clients:

### 6.3.1 Alternative Fuels Testing

The federal and provincial energy ministries contracted ITC to develop and test alternative fuels for road vehicle use. These fuels included gasohol, propane, and methanol--both low percentage and neat blends.

These programs involved the development of a quality assurance fuel and vehicle testing system. This was required to permit the determination and evaluation of anomalies which could affect vehicle performance. To this end, the scope of work under these programs included: fuel and lubricant analysis, fuel formulation and evaluation, vehicle and engine performance testing, and the adjustment of vehicles to achieve improved performance under Manitoba climatic conditions.

### 6.3.2 Hazardous Waste Analysis

ITC provided an essential service to clients who required the analysis of hazardous wastes for such parameters as PCBs, chlorophenols, herbicide and pesticide residues, petroleum residues, and heavy metal contamination.

### 6.3.3 Feasibility Studies and Reviews

A variety of studies have been carried out including:

- solids reduction in tannery effluent
- equipment evaluation for environmental improvement to a battery reclamation plant
- processes for the reduction of sulfur dioxide stack gas emissions

### 6.3.4 Chemicals from Biomass

ITC has assisted clients in the development of processes for converting biomass to liquid fuels and chemicals including:

- development of test techniques and the analysis for complex sugar solutions,
- evaluation of a potential process for the manufacture of ethanol from cellulose, and
- development of an organo-solv delignification procedure.

### 6.3.5 Cryobiological Services

ITC established and operates a bovine embryo freezing facility in Manitoba for the livestock industry.

## 6.4 Facilities

ITC has the following analytical instrumentation and biotechnology equipment:

### 6.4.1 Analytical Instrumentation

- five gas chromatographs
- a high performance liquid chromatograph
- an atomic absorption spectrophotometer
- an IR and a UV/VIS spectrophotometer
- full range of equipment for fuel, oil and lubes analysis

### 6.4.2 Biotechnology Equipment

- tissue culture facility
- electrophoresis (vertical/horizontal systems)
- high speed centrifuge
- continuous fermenter
- constant temperature baths

## 6.5 Accredited Tests

ITC is accredited by the Standards Council of Canada as a Testing Organization for specific tests registered with the Council. These tests are:

- Ignition Loss of Cured Reinforced Resins (ASTM D2584)

- Fuels and Lubricants

- Analysis, Quantitative
  . Aromatics by Gas Chromatography (ASTM D2267)
  . Ethanol in Gasohol (ITC Method)
  . Methanol and Isobutanol in Gasohol (ITC Method)
  . Methanol and Isopropanol in Gasohol (ITC Method)
  . Sulphur by General Bomb (ASTM D129)
  . Water by Karl Fischer Reagent (ASTM E203)
  . Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (ASTM D240)
  . Vapour Pressure by Reid (ASTM D323)
  . Volatility. Distillation (ASTM D86)
  . Manganese in Gasoline by AA (ASTM D3831)
  . Lead in Gasoline by AA EPS (1-AP-73-3)
  . Gasoline Dilutent by GC (ASTM D3525)
  . Isolubles in Used Lubricating Oils (Procedure B)(ASTM D893)
  . Specific Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer (ASTM D1298)
  . Water and Sediment in Fuel Oils by Centrifuge (ASTM D1796)

- Solid Fuels and By-Products

  . Calorific Value of Solid Fuels. by Adiabatic Bomb (ASTM D2015)
  . Kinematic Viscosity of Transparent and Opaque Liquids (ASTM D445)
  . Neutralization Number by Potentiometric Titration (ASTM (D664)
  . Standard Test Methods for Cyanides in Water, Methods A and C (ASTM D2036)
  . Proposed EPA Method (1980) Polychlorinated Biphenyls in Oil

The Manitoba Research Council operates two technology centres:

INDUSTRIAL TECHNOLOGY CENTRE - Winnipeg - 1-204-945-6000
- Brandon - 1-204-728-3372

CANADIAN FOOD PRODUCTS CENTRE - Portage la Prairie - 1-204-857-7861
- specializing in technical needs relating to the food, feed and beverage industries.

The Centres, under the direction of the Manitoba Research Council, work in cooperation with private sector associations, local universities, consulting firms, and other provincial and national research organizations in the delivery of specialized technical R & D services.